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B. T. GALLOWAY, *Chief of Bureau.*

CRANBERRY SPRAYING EXPERIMENTS IN 1905.

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C. L. SHEAR, PATHOLOGIST.

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CRANBERRY SPRAYING EXPERIMENTS IN 1905.

INTRODUCTION.

In Farmers' Bulletin No. 221[1] a brief account was given of cranberry diseases and also the results of spraying experiments with Bordeaux mixture. The results in 1904 were not entirely satisfactory. This was not due, however, to the inefficiency of Bordeaux mixture, but to circumstances which prevented the applications being made at proper intervals. The results obtained in 1904 showed an average of 21.7 per cent of rotten berries on the sprayed plats, as compared with an average of 76.8 per cent rotten on the unsprayed check plats. Considering the unsatisfactory manner in which the Bordeaux mixture was applied, the prediction was ventured that it would be possible with more thorough treatment to reduce the loss from rot to 10 or 15 per cent. The results obtained in 1905 have more than justified this prediction.

The experiments were conducted on what is known as the Bunker Hill bog at Whitesville, N. J., which is in charge of Mr. James D. Holman, the same plats being used as in 1904, with the addition of a small area not heretofore sprayed. This bog was selected because the fruit has in former years been almost entirely destroyed by disease. The water was drained from the bog May 10–12. It is the usual practice of cranberry growers to flood bogs for twenty-four hours during the first week in June, in order to destroy insects. In these experiments it was planned to spray part of the experimental plats before this second flooding and part immediately afterwards, in order to determine the necessity or desirability of spraying before this flooding. The water supply of the bog was, however, insufficient to flood it at the usual time, and it was not done.

The spraying apparatus used was a barrel and force pump fitted with two lengths of half-inch hose, each length provided with an extension rod and two Vermorel nozzles. The apparatus was driven about the bog in a low-bodied spring wagon, as shown in figure 1.

The Bordeaux mixture used consisted of 6 pounds of copper sulphate (bluestone) and 6 pounds of fresh stone lime to 50 gallons of water, to which was also added 4½ pounds of commercial resin-fishoil soap. The addition of this soap has been found to be indispensable, as Bordeaux mixture will not spread over and adhere satisfactorily to the glossy surface of the cranberry leaves and fruit without it. Heretofore this soap

[1] Farmers' Bulletin No. 221, U. S. Dept. of Agriculture, "Fungous Diseases of the Cranberry."

has been made as it was needed for use. Its manufacture was not an altogether pleasant operation. Now that the soap is being manufactured and placed on the market at about 3 cents per pound, it is cheaper and much more convenient to purchase it than to make it.

SPRAYING AND ITS RESULTS.

The sprayed plats were numbered 3, 5, 6, 7, and 9, the plats between being left as checks. Plats 3 and 7 were sprayed five times, as follows: May 19, June 22–23, July 14–17, July 31–August 1, and August 15–17. On September 8 accurate counts were made of all the diseased and sound berries on small areas, showing the average condition of the berries on the sprayed plats; also of equal areas, showing the average

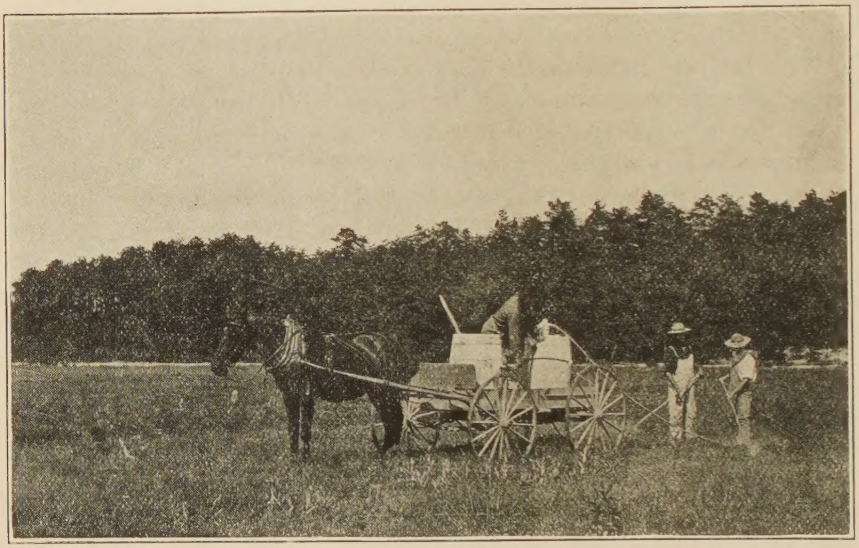

FIG. 1.—The apparatus used in the spraying experiments.

condition of the berries on the check plats. Plat 3 gave 3.23 per cent of rotten berries, plat 7 gave 8.8 per cent of rotten fruit, check plat 2 showed 91 per cent of rotten fruit, check plat 8 gave 91.53 per cent of rotten berries, giving an average of a fraction over 6 per cent of rotten fruit for the sprayed plats and a little more than 91 per cent for the unsprayed plats. On these two plats it will be noted that the first application was made on May 19, when the vines had but just commenced to put out new growth. This application was the one mentioned as being made before the usual flooding for insects.

Plats 5 and 9 were sprayed five times, as follows: June 2, June 22–23, July 14–17, July 31–August 1, and August 15–17. On June 2, when the first application was made to these plats, there was a good growth of young shoots and leaves. Counts of fruit on small areas, as in the

preceding case, gave the following results: Sprayed plat 5, 2.62 per cent of rotten berries; sprayed plat 9, 2.1 per cent of rotten fruit; check plat 4, 91.8 per cent rotten; check plat 10, 93.5 per cent rotten, giving an average of 2.36 per cent of rotten berries on the sprayed plats and 92.6 per cent of rotten fruit on the unsprayed plats. There was very little difference in the amount of rot on this series of plats and that on the series mentioned in the preceding paragraph.

Plat 6 was sprayed but three times, as follows: July 14–17, July 31–August 1, and August 15–17. Counts made, as in the previous cases, on September 8, gave the following results: Sprayed plat, 18.3 per cent of rotten berries; check plat, 91.53 per cent of rotten fruit. It may also be added that a greater number of the berries from this sprayed plat decayed before they were ready for shipment than was the case with the fruit from the plats which received five applications.

The fruit from an area of 1,048 square feet, showing average condition of fruit on sprayed plat 7, was carefully hand picked and produced 3 bushels of sound fruit, which is at the rate of about 125 bushels per acre. The same area from check plat 8, showing the average condition of fruit, gave a scanty peck, or at the rate of about $10\frac{5}{12}$ bushels per acre. In other words, there was twelve times as much sound fruit on the sprayed as on the unsprayed plat, or a saving of over 100 bushels per acre.

Besides our purely experimental plats, several acres upon another cranberry bog known as "Long Swamp" were sprayed by Mr. Holman. One portion was sprayed five times on the following dates: June 6–10, June 26–28, July 18–21, August 2–4, and August 18–19. One part was sprayed only four times. The first plat, which was also sprayed in 1904, was estimated to have from 80 to 100 per cent of the fruit sound on September 15. On the area sprayed only in 1905 it was estimated that from 70 to 90 per cent of the fruit was sound. On the plat which only received the first four applications the fruit showed somewhat more rot than on the other plats at picking time. The fruit on these plats has in former years been almost entirely destroyed by rot.

IMPORTANCE OF EARLY APPLICATIONS.

The difference in the appearance of the fruit on the sprayed and unsprayed plats was very marked by the middle of July. On the unsprayed plats a large proportion of the fruit was blasted, owing to the early attack of the scald fungus (Guignardia), while on the sprayed plats but little blasted fruit was to be seen. In many cases at least one-half of the fruit is destroyed by blasting, the young fruits being attacked by the fungus at about the time the blossoms begin to fall. In order to prevent this, one of the applications of Bordeaux mixture should be made immediately after the vines have reached their maximum flowering

stage, as a delay of a week at this time may make a difference of from 25 to 50 per cent in the amount of fruit destroyed by blasting.

A very striking illustration of this fact was observed upon another bog where one plat had been sprayed on July 1 and another adjoining was not sprayed until July 8. On the plat sprayed on July 1, when the vines had just reached their maximum flowering condition, but very little blasted fruit could be found, whereas on the plat which had been sprayed on July 8 about one-half of the fruit had been blasted. This and other observations indicate the exceedingly great importance of prompt and thorough early applications of the fungicide. In case the bog to be sprayed is flooded for insects early in June, the first application of Bordeaux mixture should be made within a day or two after the water is removed, the second application just as the plants begin flowering, and the third just after the majority of the blossoms have appeared, which in ordinary seasons will be about the first of July.

EFFECT OF SPRAYING PLANTS WHEN IN FULL BLOOM.

In order to determine whether any injury would result from spraying the plants while in bloom, part of one plat was sprayed when in full bloom, and the amount of fruit which set upon this plat was carefully compared with that on adjoining plats which had not been sprayed. No difference could be noted in the amount of fruit on the sprayed and on the unsprayed plats. In addition, certain bunches of vines were dipped in Bordeaux mixture when in full bloom, but without any apparent injury to the fruit. From our observations and experiments it does not appear that there is much danger of loss from spraying vines while in bloom. What little loss might possibly arise from this cause would be very slight compared with the amount of loss from blasted fruit in case the spraying was delayed too long.

KEEPING QUALITIES OF SPRAYED AND UNSPRAYED FRUIT.

A comparison of the sprayed and unsprayed fruit at the time of picking does not give an exact idea of the amount of profit derived from the treatment, as there was a much greater loss of unsprayed than of sprayed fruit between the time of picking and the time the berries were marketed.

In order to compare the keeping qualities of the sprayed and unsprayed fruit, as well as unsprayed fruit which had been treated with a solution of copper sulphate (1 part to 1,000 of water), 3,600 berries, perfectly sound so far as could be seen from external appearance, were selected from fruit picked on September 18, 1905. Of these, 1,200 were from the sprayed plats and the remainder from the unsprayed check plats. These berries were kept in glass dishes in the laboratory and counted each week, in order to determine the amount of disease

which developed. On October 18, about the time the fruit from the bog was marketed, 9.8 per cent of the sprayed fruit showed diseased berries, while 38.1 per cent of the unsprayed fruit and 37.4 per cent of the unsprayed fruit which had been treated with the copper-sulphate solution were diseased. In other words, four times as much of the unsprayed fruit decayed between the time of picking and marketing as of the sprayed fruit.

Parts of the check plats which were worth picking were picked by hand and the fruit kept separate. This fruit was sorted for shipment on October 15, 1905, when from 85 to 90 per cent of it was rotten. Mr. Holman states that 40 per cent of all the unsprayed berries from Bunker Hill bog decayed between the time of picking and marketing. No treatment of the berries with fungicides after picking is likely to give satisfactory results. as we have found that the decay which occurs in storage does not arise from germs which are on the surface of the fruit at the time it is picked, but apparently from a dormant form of the fungus already within the berries, where it is awaiting favorable conditions for development.

As the time for picking approached, so much of the Bordeaux mixture adhered to the sprayed fruit that it was feared enough might be present when the berries were marketed to interfere with their sale. This, however, did not prove to be the case, as the greater portion of the mixture was removed from the fruit during the process of picking, sorting, and preparing the fruit for market.

As the result of three years' spraying experiments, it is safe to say that by the proper use of Bordeaux mixture the loss from fungous diseases can be reduced to 10 per cent or less. The loss may be slightly more the first year a badly diseased bog is treated, as the benefit, as shown in these experiments, is greater the second year than the first, and is evident not only in the prevention of scald and rot of the fruit, but in the general improvement, thriftiness, and productiveness of the vines. Bordeaux mixture has also been applied with very beneficial results to young vines not yet in bearing, the leaves of which were badly affected by the scald fungus.

COST AND RECOMMENDATIONS.

The cost of the spraying as it was done in these experiments averaged from $15 to $20 an acre, the mixture being applied at the rate of four barrels, or 200 gallons, an acre at each application, making for the five applications a total of 1,000 gallons to the acre.

In undertaking the application of Bordeaux mixture it is necessary that all material and apparatus be in perfect readiness before the time to begin the work, and nothing should be allowed to interfere with the application of the fungicide at proper intervals; otherwise, the results

will be unsatisfactory, and the remedy is likely to be unjustly condemned.

The necessity for care and thoroughness in the preparation and application of the mixture must also be strongly emphasized. The mixture should be made as described in Farmers' Bulletin No. 221, using only good, fresh stone lime and adding resin-fishoil soap. A good nozzle (the Vermorel type is best) should be used and the vines very thoroughly covered at each spraying. Four barrels of the mixture to the acre are ordinarily sufficient, but where the vines are very dense and heavy five barrels may be necessary. Where there is an excessive growth of vines, it will be found advantageous to rake them with a knife rake and thin them out, as is frequently done in order to prepare a bog for picking with scoops.

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